Dec. 29, 1925. 1,567,550

A. H. STEBBINS

OPERATING MEANS

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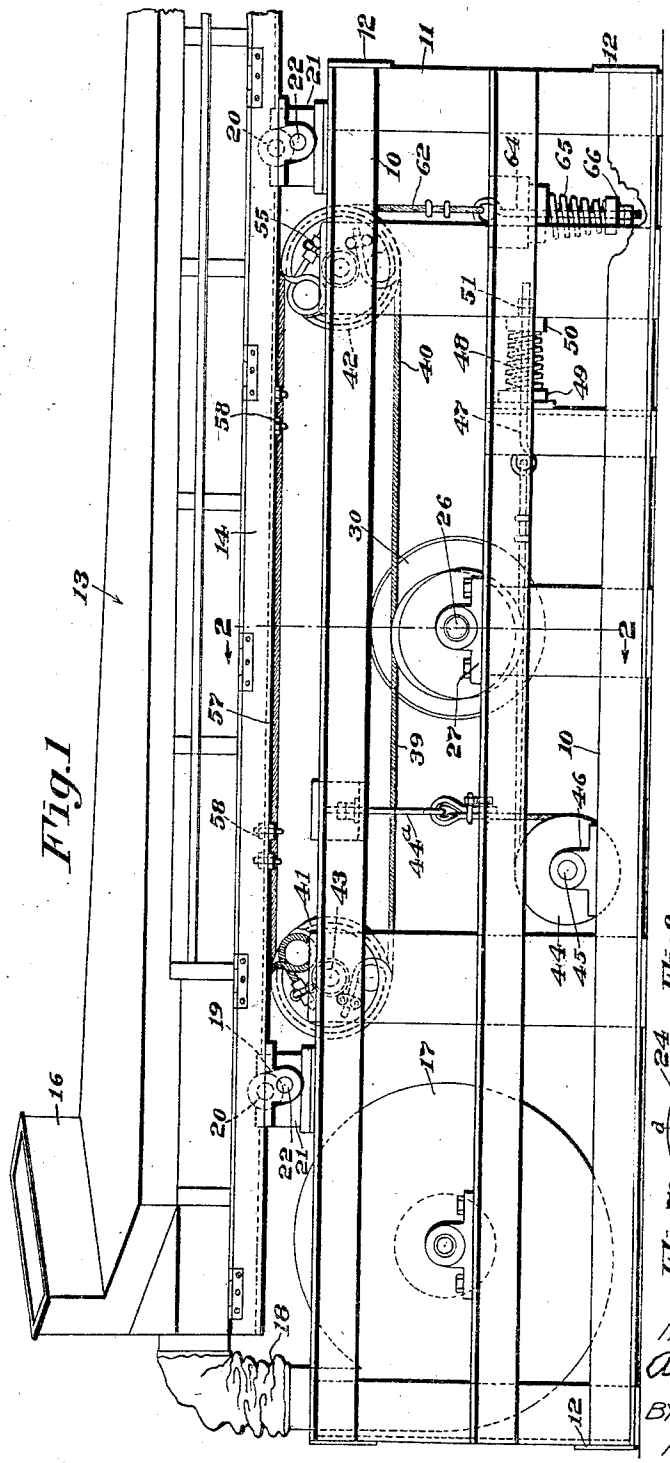


Fig. 1

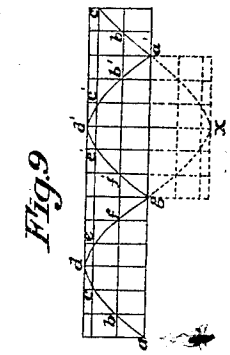


Fig. 9

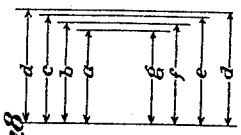


Fig. 8

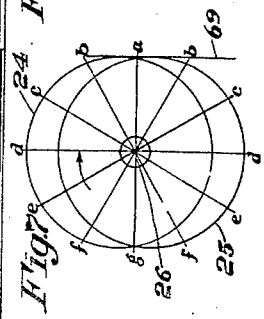


Fig. 7

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OPERATING MEANS

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Fig. 3

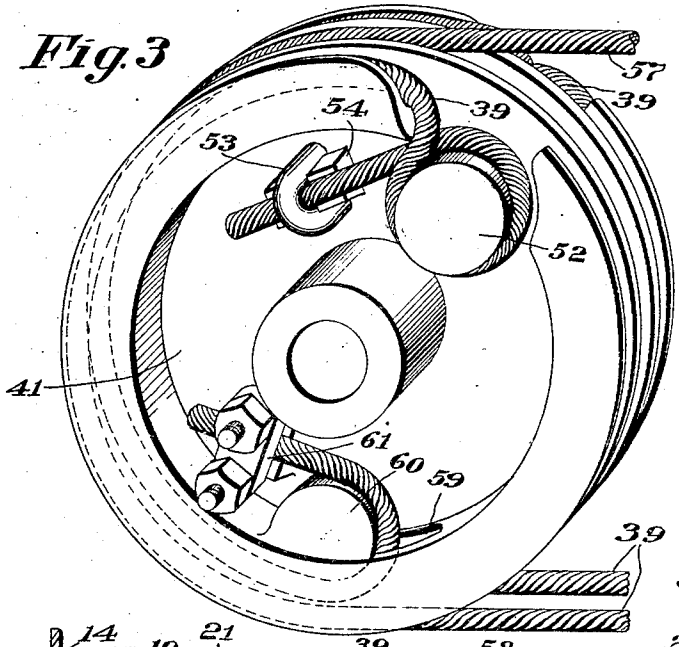



Fig. 4

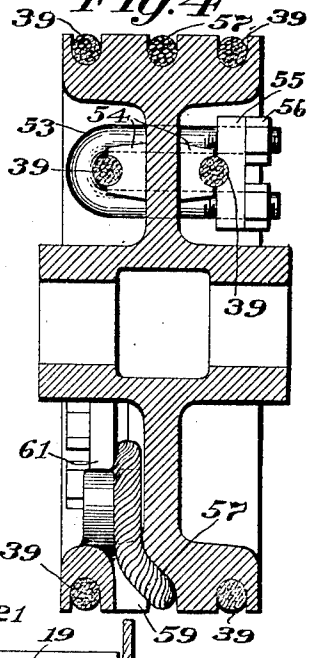
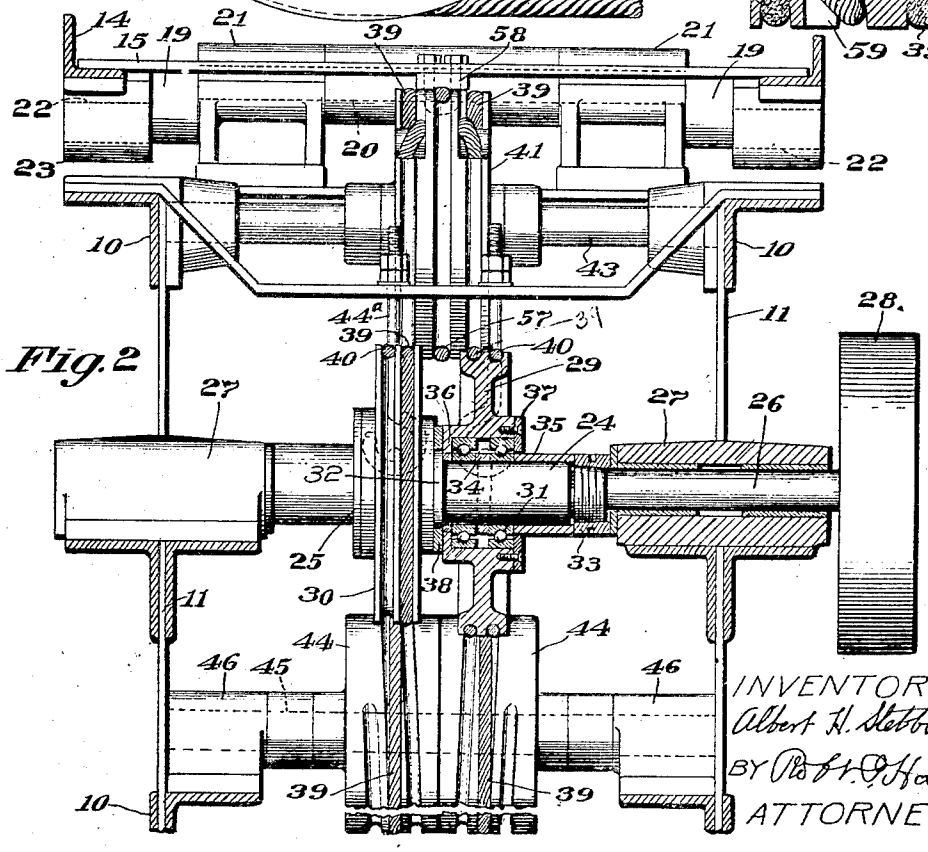



Fig. 2




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OPERATING MEANS

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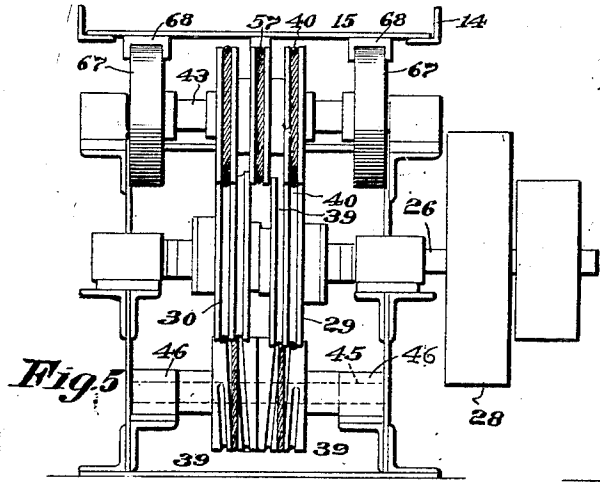



Fig. 5

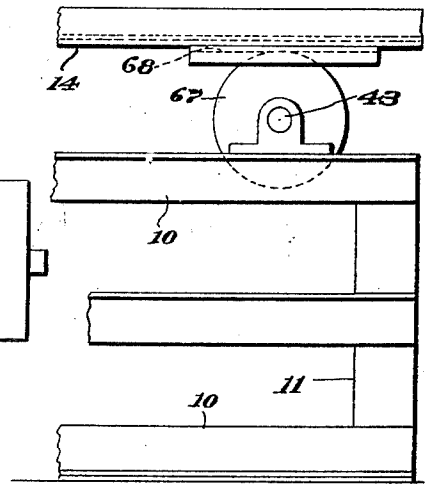



Fig. 6

Fig. 10

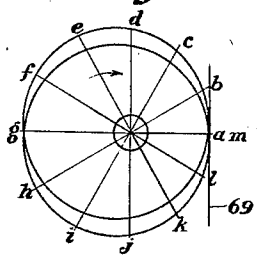



Fig. 11

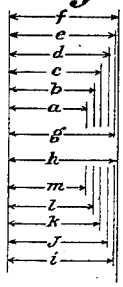



Fig. 12

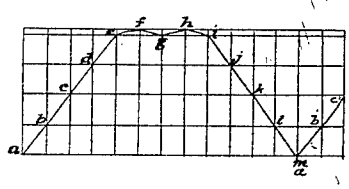
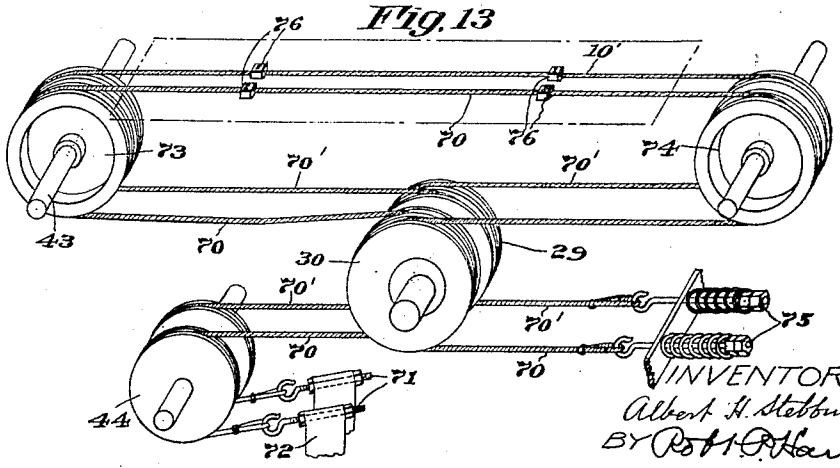


Fig. 13




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Patented Dec. 29, 1925. 1,567,550

# UNITED STATES PATENT OFFICE.

ALBERT H. STEBBINS, OF LOS ANGELES, CALIFORNIA.

## OPERATING MEANS.

Application filed October 3, 1924. Serial No. 742,337.

*To all whom it may concern:*

Be it known that I, ALBERT H. STEBBINS, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented an Improvement in Operating Means, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to improved means for imparting a progressive movement to concentrator decks and other forms of separators or mechanical devices employing a vibratory movement.

The vibratory movement imparted to the deck of a concentrator table usually serves to advance the materials being treated lengthwise of the deck, and commonly serves also to promote stratification and settling of the materials. In accomplishing these results the deck must not be vibrated with sufficient force to disturb the different strata into which the materials are being formed.

The movement commonly employed to promote travel of materials upon a deck surface or other material treating surface is a back and forth movement that reverses the direction of travel more abruptly at one end of the path of travel than the other. Various different operating means have been proposed heretofore for supplying this movement, and, while some of these devices work fairly well, they are more or less complicated and are open to other objections.

The primary object of the present invention, therefore, is to provide simple means for imparting a better progressive movement to a concentrator deck or other device than has been developed heretofore.

An important feature of the invention resides in a pair of eccentrics that are angularly disposed to each other to operate a deck or other form of separator employing a vibratory movement and in which each eccentric modifies the action of the other eccentric.

By varying the angle between the eccentrics any desired progressive movement may be obtained, and the reversal of the direction of movement can be made as abrupt as desired by arranging the eccentrics so that while the reciprocatory surface is moving rapidly under the control of one eccentric, it is suddenly reversed by the action of the other eccentric.

When an ordinary eccentric is employed to impart a reciprocatory movement to an element, the speed of movement is greatest at a point about midway between the ends of the path of travel and slows down at each end. By the arrangement of the present invention the reversal of movement can be effected at the moment the material supporting surface is moving at its greater speed under the control of one eccentric, and this is effected by causing the other eccentric to become active at this instant to move the surface in the opposite direction. The sudden reversal of movement causes the materials to slide along the supporting surface.

Another feature of the invention resides in an eccentric provided with a cable for pulling the material supporting surface in one direction, and in a second eccentric angularly disposed to the first and provided with a cable for pulling the surface in the opposite direction.

Other features of the invention and novel combination of parts, in addition to the above, will be hereinafter described in connection with the accompanying drawings, which illustrate good, practical forms thereof.

In the drawings,—

Fig. 1 is a side elevation of a concentrator table provided with operating means constructed in accordance with the present invention.

Fig. 2 is an enlarged sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged perspective view of one of the sheaves to which the ends of the cables are secured.

Fig. 4 is a vertical sectional view thru the sheave of Fig. 3.

Fig. 5 is an end view of the supporting casing shown in Fig. 1 and disclosing a modified form of means for supporting the deck.

Fig. 6 is a side view of a portion of the structure shown in Fig. 5.

Figs. 7, 8 and 9 are diagrammatic views, showing the action of a pair of eccentrics disposed at an angle of 180 degrees to each other.

Figs. 10, 11 and 12 are diagrammatic views showing the action of a pair of eccentrics disposed at an acute angle to each other; and

Fig. 13 is a perspective view showing a modified arrangement of the operating cables.

In the drawings the operating means of the present invention is shown as used upon a concentrator table for imparting back and forth movement to the deck, but it will be understood that this operating mechanism may be used upon various devices where a vibratory or progressive movement is desired.

Referring to Figs. 1 to 6 inclusive, the concentrator table is provided with a supporting casing of any well known or preferred construction and consisting of longitudinally extending side beams 10 secured to uprights 11 and the opposite sides of the casing are connected by transversely extending rails 12. Upon the supporting casing is mounted the deck 13 of any preferred or well known construction, and having a supporting frame consisting of longitudinally extending rails 14 connected by transversely extending bars 15. The materials to be treated are supplied to the deck by the hopper 16. Air is supplied to the deck 13 under pressure by the fan 17, the outlet of which is connected to the deck by a flexible tube 18.

Various means may be provided for supporting the deck 13 for back and forth movement upon the supporting casing, and in the construction shown in Figs. 1 and 2 the supporting means for the deck consists of rocking arms 19, the upper ends of which are secured to a transversely extending shaft 20 mounted in brackets 21 secured to the supporting casing. The lower portion of the arms 19 are provided with laterally extending stub shafts 22 which are journaled in brackets 23 and these brackets are rigidly secured to the deck supporting frame. The supporting means just described are provided near the opposite ends of the deck and the rocking movement of the arms 19 causes the deck to rise and fall slightly as it moves in the direction of its length. The mechanism so far described forms no part of the present invention and may be variously constructed.

As stated an important feature of the invention resides in operating eccentrics disposed at an angle to each other. Various means may be provided for imparting movement from the angularly disposed eccentrics to a deck or other device to be operated. In the construction shown the angularly disposed eccentrics 24 and 25 are secured to or formed integral upon a transversely extending shaft 26 which shaft is journaled in bearings 27 secured to the supporting casing, and the shaft may be rotated by a pulley 28. In the construction shown the eccentric 24 is provided with a sheave 29 having two cable receiving grooves, and the eccentric 25 is provided with a similar sheave 30. It is desirable that the eccentrics be mounted to rotate within the sheaves so that they may impart their eccentric movement to the sheaves without rotating them. To this end the anti-friction bearings 31, of any well known or preferred construction, are provided about the eccentrics and are mounted within the hub of the sheaves. The inner rings of the anti-friction bearings 31 are secured in place upon the eccentrics by clamping them between the shoulder 32, which may be formed integral upon the shaft, and a nut 33 having threaded engagement with the shaft, a suitable number of collars 34—35 being provided to take up the space between the shoulder 32 and nut 33. The sheaves 29 and 30 are maintained in place upon the outer rings of the anti-friction bearings by an integral flange 36 at one side of each sheave, and by a removable flange 37 secured to the opposite side of the sheave by screws. Movement of the sheaves 29 and 30 towards each other may be limited by a loose collar 38 surrounding the shoulder 32 and positioned between the sheaves. In the construction shown in Figs. 1 to 6 inclusive each sheave is provided with two cables 39 and 40, one lying in each groove of the sheave and these cables extend in opposite directions and are secured to the deck or other surface to be moved back and forth, the arrangement being such that, as the operating eccentric rotates, the deck is pulled in first one direction and then the other by the cables 39 and 40. In the present case the cables 39 and 40 are not directly secured to the deck 13, but the cable 39 has one end anchored to an idle sheave 41 and the cable 40 has one end anchored to the idle sheave 42. The sheaves 41 and 42 are disposed near the opposite ends of the deck and are rotatably supported by transversely extending shafts 43. The opposite end portion of the cable 39 passes around an idle sheave 44 and has its end secured to the hooked portion of the bolt 44ª, the sheave 44 being rotatably mounted upon the transversely extending shaft 45, the opposite ends of which are supported by brackets 46. The opposite end portion of the cable 40 is yieldingly anchored to the supporting casing by means of a bolt 47 provided with a coiled spring 48 confined between a cap plate 49 that rests against a portion of the casing and a second cap plate 50 secured upon the bolt by nuts 51, the arrangement being such that the tension of the spring may be varied by adjusting the nuts 51. As best shown in Fig. 3 it will be seen that each sheave 41 and 42 is provided with three

cable receiving grooves and the outer cables 39 lie in the outer grooves and extend upwardly approximately half way around the sheave at which point the end of each cable 39 is looped around a stud 52 and is then secured to the sheave by a U-shaped clamp 53. The end of one of the cables 39 is gripped between the rounded bottom portion of the clamp 53 and a block 54, while the end of the other cable 39 is confined between a similar block 54 and a cross-bar 55 secured upon the legs of the U-shaped clamp by nuts 56.

The sheaves 41 and 42 are connected to the deck 13 by a cable 57 which may be clamped to the under face of the deck at one or more points 58 and one end of the cable 57 lies in the central groove and is anchored to a sheave 41, while the opposite end of the cable 57 lies in the central groove and is anchored to the sheave 42. The opposite ends of the cable 57 are shown as passing approximately half way around the respective sheaves and then extend inwardly thru an opening 59 to pass around the lug 60 and then to the clamp 61. As a result of the construction just described, it will be seen that the rocking movement imparted to the sheaves 41 and 42 by the cables 39 and 40 will be transmitted to the deck by the cable 57.

It should be kept in mind that the sheaves 29 and 30 are actuated by angularly disposed eccentrics and as a result one of the cables 39 may remain slack while the deck is being pulled in a left-hand direction by the other cable 39. This will cause the deck to move in a left-hand direction at a decreasing speed and to gradually reverse its direction of movement at the left-hand end of its path of travel and then start in a right-hand direction with a gradually increasing speed, and about the time the deck reaches its maximum speed of movement in a right-hand direction, the second cable 39 may suddenly become taut under the action of its eccentric, to suddenly reverse the direction of movement of the deck, thus imparting a progressive movement to the materials being treated by the deck. As long as one cable 39 receives a deck operating movement from its eccentric, the corresponding cable 40 will be let off from one side of the eccentric sheave at the same rate that the cable 39 is taken up by the opposite side of this sheave, and as a result the tension of the corresponding spring 48 will not be varied, but, if the entire load is upon one cable 39 and the opposite cable 39 is slack, the slackness of this cable will be supplied by the second spring 48 being compressed by the second cable 40.

It will be understood that the cables 39 are subjected to the greatest pull, as these are the cables which suddenly arrest the movement of the deck 13 in a right-hand direction, and they serve also to move the deck 13 in a left-hand direction against the tension of the springs 48. As just stated the cables 39 are subjected to a greater strain than the cables 40; the idle sheaves 44 are therefore provided between the eccentric sheaves and the bolts $44^a$ to relieve these bolts from the lateral movement which is imparted to the cables by the rise and fall of the sheaves 29 and 30 under the action of their eccentrics.

From the foregoing description it will be seen that the deck 13 is moved positively in a left-hand direction, and that it is moved yieldingly in a right-hand direction, the deck being pulled in a right-hand direction partly by the action of the eccentrics upon the cables 40, but to a greater degree by the action of the springs 48 upon the ends of these cables. Should it be desirable to provide additional means for pulling the deck 13 in a right-hand direction, this may be accomplished by providing a short, additional cable 62, one end of which is anchored to the sheave 42, and the other end of which is secured to the hooked end of the bolt 64, which bolt is urged downwardly by the spring 65, and the tension of the spring may be varied by adjusting the nuts 66 at the lower end of the bolt 64.

In Figs. 5 and 6 a modified construction is shown for supporting the deck or other device for back and forth movement, and in this case the supporting arms 19 and associated parts shown in Fig. 1 are omitted, and the supporting frame of the deck 13 rests directly on the wheels 67, mounted upon the transversely extending shafts 43. The under surface of the deck-supporting frame may be provided with wear blocks 68 which have downwardly extending side flanges to engage the opposite edges of the supporting wheels, as will be apparent from Figs. 5 and 6, the arrangement being such that the side flanges of the block 68 prevent lateral movement of the deck upon the supporting wheels and restrict the movement of the deck to a straight, longitudinal path. The wheels 67 may be loosely mounted upon the shafts 43, or if preferred they may be rigidly secured to these shafts. In case the sheaves 41 and 42 are rigidly secured to the shafts 43, it will be seen that the rocking movement of these sheaves will be imparted thru the shafts 43 to the wheels 67, thus positively rotating these wheels, and this will help to impart a back and forth movement to the deck. The modification shown in Figs. 5 and 6 does not differ from the construction shown in Figs. 1 to 4 inclusive, except in the means just described for mounting the deck upon the supporting casing.

The nature of the movement imparted

to the deck 13, or other mechanism to be operated, may be varied as desired by varying the angle between the eccentrics, the speed at which the eccentrics are rotated, and the size of the eccentrics, and the movement may be still further varied by employing more than two eccentrics, if desired. The nature of the movement produced by the angularly disposed eccentrics will be more clearly understood upon an examination of Figs. 7 to 12 inclusive. In Figs. 7, 8 and 9 the eccentrics are indicated as disposed at an angle of 180 degrees to each other, and in Fig. 7 the line 69 may be regarded as a bar or level which is held against the eccentrics. As these angularly disposed eccentrics are rotated in the direction indicated by the arrow, it will be seen that the bar 69 will be moved outwardly as the points *b*, *c* and *d* of the eccentric 24 are successively brought into operative engagement with this bar, and the successive positions to which the bar 69 is moved are indicated in Fig. 8 by the length of the lines *a*, *b*, *c* and *d*. Upon examining the curve shown in Fig. 9, it will be seen that the speed at which the bar 69 is operated decreases as the points *b*, *c* and *d* are successively reached, and increases as the points *e*, *f* and *g* are brought into engagement with this bar. As the bar approaches the position in which it is engaged by the point *g* it is moving at approximately its maximum speed, and it should be noted that at this instant the second eccentric 25 engages the bar and suddenly reverses its direction of movement, as indicated by the curve *g*, *f'*, *e'*, *d'*. The abrupt turn in the curve at the point *g* clearly indicates the reversal of movement imparted to the deck 13, which imparts the desired progressive movement to the materials. If the eccentrics 24 and 25 are disposed at an angle of 180 degrees to each other, then the curve *a*, *d*, *g* of Fig. 9 indicates the movement of the deck 13 under the control of one cable 39, and the curve *g*, *d'*, *a'* indicates the corresponding movement of the deck 13 under the control of the second cable 39. Should one of these cables be omitted then the movement imparted to the deck would be indicated by the curve *a*, *d*, *g*, *x*, *a'*, in which case it will be noted that the reversal of movement at each end of the path of travel is gradual and that no progressive movement is imparted to the deck, but by providing the two angularly disposed eccentrics in accordance with the present invention, the control of the deck passes suddenly from one eccentric to the other, when the deck is moving at its maximum speed, thus imparting to the deck the desired quick reversal of movement. If the eccentrics 24 and 25 are disposed at an acute angle to each other, as indicated in Fig. 10, the nature of the movement imparted to the deck 13 will be clear upon examining Figs. 10, 11 and 12. In Fig. 12 it will be noted that a slight dip occurs in the curve at the point *g*. This occurs at the instant the point *g* of Fig. 10 moves into engagement with the lever or bar 69, and is due to the fact that the radius *g* is slightly shorter than the radii *f* and *h*. This slight dip, as indicated in Fig. 12, may not appreciably affect the movement of the deck, except to make more gradual the reversal of movement at the left-hand end of the path of travel. This dip, however, may be made as great as desired by increasing the angle between the two eccentrics.

It is not essential that the operating cables have their ends secured to the sheaves 41 and 42, as shown in Fig. 1, and in Fig. 13 a modified construction is shown, in which the operation is substantially the same as that described in connection with Fig. 1; but two long cables 70, 70' are employed in place of the pairs of cables 39, 40, 57 of Figs. 1 to 6 inclusive. In Fig. 13 one end of the cable 70 is anchored to the adjustable bolt 71 secured to a fixed stud or portion of the supporting frame 72. From the bolt 71 the cable 70 passes around the idle sheave 44, eccentric sheave 30, longitudinally spaced sheaves 73 and 74, around the opposite side of the sheave 30 and is then secured to the yielding bolt 75. The second cable 70' is similarly disposed except that it engages the eccentric sheave 29 instead of the sheave 30. The sheaves 73 and 74 differ from the sheaves 41 and 42 in that the former have two grooves instead of three, and the cable securing means shown in Fig. 3 are omitted. The portion of the cables 70 and 70' extending between the sheaves 73 and 74 are secured at 76 to the deck or other device to be operated.

The portion of the cable 70 extending between the sheaves 30 and 73 is shown slack, as it is assumed that the entire load at this instant is on the cable 70', due to the fact that the eccentric 24 at this instant is moved further in a right-hand direction than the eccentric 25. The slack of the cable 70 is supplied by compressing the spring upon the bolt 75 at the yielding end of this cable, as shown, it being understood that the means 76 for securing the cables to the deck prevents the slack of the cable 70 from being distributed thruout the entire length of the cable.

The use of two angularly disposed eccentrics, in accordance with the present invention, produces an excellent progressive movement, and since the movement can be varied as desired by changing the angle between the eccentrics, the size of the eccentrics and their speed of rotation, it is admirably adapted for operating a concentrator deck. It can also be varied to form an ex-

cellent movement for screens and other surfaces to be vibrated, and altho two angularly disposed eccentrics are shown and described, more than two may be employed to obtain a desired movement.

What is claimed is:—

1. A device of the class described comprising, in combination, a supporting casing, a frame provided with a material supporting surface and mounted upon the casing for movement back and forth in the direction of its length, means for moving the frame in one direction, a pair of cables for moving the frame in the opposite direction and for controlling the movement of the frame under the action of said means, and a pair of eccentrics for operating the respective cables, said eccentrics being angularly disposed so that one controls the movement of the frame thru one cable during part of a complete revolution and the other eccentric controls the movement of the frame thru the second cable during a different portion of said complete revolution.

2. A device of the class described comprising, in combination, a supporting casing, a frame mounted upon the casing for back and forth movement and having a material supporting surface, means for moving the frame in one direction, a pair of cables for moving the frame in the opposite direction and for controlling the movement of the frame under the action of said means, a pair of eccentrics for operating the respective cables and angularly disposed so that each cable under the influence of its eccentric modifies the action of the other cable upon the frame.

3. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing to receive a back and forth vibratory movement, a pair of eccentrics disposed at an angle to each other and provided with driving means, a pair of cables actuated by one of the eccentrics and extending in opposite directions from the eccentric to pull the frame back and forth, and a second pair of cables actuated by the other eccentric to pull the frame back and forth so that each pair of cables modifies the movement imparted to the frame by the other cables.

4. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing to receive a back and forth vibratory movement, a pair of eccentrics disposed at an angle to each other and provided with driving means, a pair of cables actuated by one of the eccentrics to pull the frame back and forth, a second pair of cables operated by the other cable to pull the frame back and forth so that each eccentric modifies the movement imparted to the frame by the other eccentric, and springs connected to the cables that pull the frame in one direction and adapted to yield to accommodate the tension upon the cables that move the frame in the opposite direction.

5. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing to receive a back and forth vibratory movement, means for yieldingly forcing the frame in one direction, a pair of cables for pulling the frame in the opposite direction, a pair of eccentrics for actuating the cables and arranged at an angle to each other so that while the frame is moving in one direction under the control of one eccentric its movement is quickly reversed by the other eccentric becoming active.

6. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing to receive a back and forth vibratory movement, means for yieldingly forcing the frame in one direction, eccentrics for moving the frame in the opposite direction and for controlling the movement of the frame under the action of said means, means for imparting the movement of one eccentric to the frame, separate and independent means for imparting the movement of the other eccentric to the frame, and a driving shaft upon which the eccentrics are secured at different angles so that each eccentric modifies the action of the other eccentric upon the frame.

7. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing to receive a back and forth vibratory movement, mechanism for yieldingly moving the frame in one direction, eccentrics for positively moving the frame in the opposite direction, means for imparting the movement of one eccentric to the frame, separate means for imparting the movement of the other eccentric to the frame and each of said means being operable independently of the other to move the frame, and a driving shaft upon which the eccentrics are mounted at different angles to each other so that each eccentric modifies the action of the other eccentric upon the frame.

8. A device of the class described, comprising, in combination, a supporting casing, a frame supported by the casing for back and forth movement and having a material supporting surface, means for moving the frame in one direction, a pair of eccentrics for pulling the frame in the opposite direction and for controlling the let-off movement of the frame under the action of said means, means for actuating the frame from each eccentric, and the eccentrics being angularly disposed so that as the frame receives a let-off movement from one eccentric it is reversed quickly by a pull from the other eccentric.

9. A device of the class described, compris-

ing in combination, a supporting casing, a frame supported by the casing for back and forth movement and having a material supporting surface, means for moving the frame in one direction, a pair of eccentrics for pulling the frame in the opposite direction and for controlling the let-off movement of the frame under the action of said means, means for actuating the frame from each eccentric, and the eccentrics being disposed at an angle of 180 degrees to each other so that each eccentric controls the movement of the frame during one-half of a complete revolution.

10. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing for back and forth movement and having a material supporting surface, a pair of eccentrics, a pair of cables operated by the eccentrics to pull the frame in one direction, a second pair of cables operated by the eccentrics to pull the frame in the opposite direction, and the eccentrics being angularly disposed so that each modifies the movement imparted to the frame by the other eccentric.

11. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing for back and forth movement and having a material supporting surface, a pair of eccentrics, a pair of cables operated by the eccentrics to pull the frame in one direction, a second pair of cables operated by the eccentrics to pull the frame in the opposite direction and the eccentrics being angularly disposed and operable to slack off one cable while the corresponding cable of the other eccentric is being pulled by its eccentric to pull the frame.

12. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing for back and forth movement and having a material supporting surface, a pair of eccentrics, a pair of cables operated by the eccentrics to pull the frame in one direction and each cable having one end positively anchored, a second pair of cables operated by the eccentrics to pull the frame in the opposite direction and each having one end yieldingly anchored, and the eccentrics being angularly disposed so that each modifies the movement imparted to the frame by the other eccentric.

13. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing for back and forth movement and having a material supporting surface, a pair of sheaves rotatably supported at points spaced lengthwise of the frame, a cable secured to the movable frame and extending therefrom about the sheaves, means for securing the ends of the cable to the respective sheaves, an operating eccentric, and cables extending from the eccentric to each sheave to rock the sheaves and move the frame back and forth.

14. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing for back and forth movement and having a material supporting surface, a pair of sheaves rotatably supported at points spaced lengthwise of the frame, a cable secured to the movable frame and extending therefrom about the sheaves, means for securing the ends of the cable to the respective sheaves, an operating eccentric, cables extending in opposite directions about said eccentric each having one end secured to a sheave and the other end secured to the supporting casing and operable to rock the sheaves and move the frame back and forth.

15. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing for back and forth movement and having a material supporting surface, a pair of sheaves rotatably supported at points spaced lengthwise of the frame, a cable secured to the movable frame and extending therefrom about the sheaves, means for securing the ends of the cable to the respective sheaves, an operating eccentric, cables extending from the eccentric to each sheave to rock the sheaves and move the frame back and forth, and a spring exerting a rotative force upon one of said sheaves to modify the movement imparted to the frame.

16. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing for back and forth movement and having a material supporting surface, means for moving the frame in one direction, a sheave rotatably supported, a cable secured to the movable frame and extending therefrom about the sheave, means for securing the cable to said sheave, a pair of eccentrics, cables extending in the same direction about said eccentrics and each having one end anchored and the other end secured to the sheave, and means for rotating said eccentrics to actuate the cables and shake the frame.

17. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing for back and forth movement and having a material supporting surface, means for moving the frame in one direction, a sheave rotatably supported, a cable secured to the movable frame and extending therefrom about the sheave, means for securing the cable to said sheave, a pair of eccentrics disposed at an angle to each other, cables extending in the same direction about said eccentrics and each having one end anchored and the other end secured to the sheave, and means for rotating said eccentrics to actuate the cables and shake the frame.

18. A device of the class described comprising, in combination, a supporting casing, a frame supported by the casing for movement back and forth in the direction of its length, wheels rotatably supported by the casing and having the frame resting thereupon, a sheave for rotating said wheels, means for moving the frame in one direction, a pair of cables to move the frame in the opposite direction and adapted to rotate said sheave and wheels, and a pair of eccentrics one for operating each of the cables.

19. A device of the class described comprising, in combination, a supporting casing, a frame mounted upon the casing for back and forth movement and having a material supporting surface, means for moving the frame in one direction, an operating shaft having a pair of eccentrics disposed at an angle to each other, sheaves mounted upon the respective eccentrics and constructed so that each eccentric may rotate freely within its sheave, and cables engaging said sheaves and operable to impart the movement of each eccentric to the frame.

20. A device of the class described comprising, in combination, a supporting casing, a frame provided with a material supporting surface and mounted upon said casing for movement back and forth in the direction of its length, means for moving the table back and forth with vibratory effect, including a pair of eccentrics, a cable actuated by one of the eccentrics to pull the frame in one direction, a cable operated by the other eccentric to pull the frame in the opposite direction, and means for rotating the eccentrics to operate the cables.

21. A device of the class described comprising, in combination, a supporting casing, a frame provided with a material supporting surface and mounted upon the casing for movement back and forth in the direction of its length, means for moving the frame back and forth with vibratory effect including a pair of eccentrics angularly disposed, a cable actuated by one of the eccentrics to pull the frame in one direction, a cable operated by the other eccentric to pull the frame in the opposite direction, and means for rotating the eccentrics to operate the cables.

22. A device of the class described comprising in combination, a supporting casing, a frame provided with a material supporting surface and mounted upon the casing for movement back and forth in the direction of its length, means for moving the frame back and forth with vibratory effect, including a shaft, a pair of eccentrics mounted upon the shaft in different angular positions, a cable actuated by one eccentric to pull the frame in one direction, a cable operated by the other eccentric to pull the frame in the opposite direction, and means for rotating the shaft to drive the eccentrics.

23. A device of the class described comprising, in combination, a supporting casing, a frame provided with a material supporting surface and mounted upon the casing for movement back and forth in the direction of its length, means for moving the frame back and forth with vibratory effect, including a pair of cables connected to the frame, a rotating shaft, and eccentric means upon the shaft and rotated thereby to tension one cable to pull the frame in one direction and tension the other cable to pull the frame in the opposite direction.

24. A device of the class described comprising, in combination, a supporting casing, a frame provided with a material supporting surface and mounted upon the casing for movement back and forth in the direction of its length, means for moving the frame back and forth with vibratory effect, including a pair of cables connected to the frame, a rotating shaft, eccentric means upon the shaft and rotated thereby to tension one cable to pull the frame in one direction and tension the other cable to pull the frame in the opposite direction, and spring means acting upon the frame to move it more energetically in one direction than the other.

25. A device of the class described comprising, in combination, a supporting casing, a frame provided with a material supporting surface and mounted upon the casing for movement in the direction of its length, transversely extending shafts rotatably supported below the frame, wheels rigidly secured to the shafts and having the frame resting upon them, sheaves rigidly secured to the respective shafts, cables for operating the frame and passing around the sheaves, and a pair of angularly disposed eccentrics adapted to pull the cables to move the frame back and forth and to rotate said wheels.

In testimony whereof, I have signed my name to this specification.

ALBERT H. STEBBINS.